



Threats from trading and hunting of pottos and angwantibos in Africa resemble those faced by slow lorises in Asia

Magdalena S. Svensson^{1,*}, Sagan C. Friant²

¹Nocturnal Primate Research Group, Oxford Brookes University, Oxford OX3 0BP, UK

²Nelson Institute for Environmental Studies, University of Wisconsin-Madison, Wisconsin 53706, USA

ABSTRACT: Hunting and trading of wildlife, including primates, has been occurring for thousands of years. However, the rapid escalation of the bushmeat trade and the trade in live animals and body parts in recent years have come to present a serious threat to biodiversity. Asian slow lorises *Nycticebus* spp. are at a high risk of extinction due to their trade in wildlife markets. The African lorisiformes (pottos *Perodicticus* spp. and angwantibos *Arctocebus* spp.) are closely related to Asian slow lorises, and show similar behaviour and ecology. Here, we present an exploratory study comparing the threats faced by African and Asian lorises. Furthermore, we examine the overall trend of the African lorisid trade. We conducted a comprehensive literature review covering all African lorisid range countries, analysed export and import data from the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) database, distributed questionnaires to researchers in the field and carried out an in-depth questionnaire in Nigeria. Pottos were the most commonly hunted primate in the Nigerian focal villages studied herein, and 72% of respondents reported eating their meat at least once a month. The questionnaire responses from researchers reported on all types of trade, varying across different areas. The literature reported hunting of Perodicticinae, but it did not mirror our findings from the 2 questionnaires. Increased research into Asian slow lorises has revealed trade to be a real impediment to their conservation, and our data strongly suggest that the threat is of equal importance to the conservation of their African counterparts.

KEY WORDS: Africa · *Arctocebus* · Conservation · *Perodicticus* · Wildlife trade · Questionnaire

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INTRODUCTION

Hunting of tropical forest animals for human consumption has been occurring for over 100 000 yr; however, during the past few decades this phenomenon has rapidly escalated (Milner-Gulland et al. 2003). At present, hunting represents one of the main threats to biodiversity within the tropics, following only habitat loss (Juste et al. 1995, Nekaris 2013). In Africa, species extinction due specifically to overhunting is a relatively recent phenomenon. The bushmeat trade in West and Central Africa is becoming particularly unsustainable, with primates

being one of the most vulnerable groups of taxa. The trade in primates, including live individuals (pet trade) and body parts (i.e. for consumption or traditional medicine), is considered a major impediment to primate conservation, especially in Africa (Brashares 2003, Milner-Gulland et al. 2003, Nijman et al. 2011, Mittermeier et al. 2012). Furthermore, the use of primates in traditional medicinal practices (including witchcraft) appears to be on the rise, both in Africa and in Asia. According to a recent review, 59% of the primate species in Asia and 32% of the primate species in Africa are used for these practices (Alves et al. 2010).

*Corresponding author: svensson_magdalena@hotmail.com

The Asian slow loris *Nycticebus* spp. has recently been recognised as being at risk of extinction due to trade (Nekaris & Nijman 2007, Starr et al. 2010, Nekaris et al. 2013). Throughout their range, slow lorises are among the most commonly occurring primates in markets, where they are sold as pets, or as body parts (Nekaris et al. 2010). These threats are, however, not restricted within national boundaries: slow lorises have recently become popular as pets worldwide, partly due to their prevalence in internet videos (Nekaris et al. 2013) and as photo props in tourist areas (P. Osterberg & K. A. I. Nekaris, this volume).

The African lorisiformes (subfamily Perodicticinae), including the pottos *Perodicticus potto*, *P. edwardsi* and *P. ibeanus*, as well as the angwantibos *Arctocebus calabarensis* and *A. aureus*, are closely related to the Asian forms (subfamily Lorissinae, *Nycticebus* and *Loris* spp.) (Groves & Butynski 2013, Nekaris 2013). The African and Asian lorisiformes share a similar evolutionary history and comparable behaviour and ecology. They are nocturnal, arboreal, relatively slow-moving primates (Nekaris 2013).

Here we present an exploratory study with the aim of answering the following questions: (1) with similar ecology and behaviour to the Asian slow lorises, do the African lorisids face threats similar to their Asian counterparts, and (2) with the primate trade in Africa on the rise, is the trade in the African lorisids also increasing? To better understand the extent of the trade within rural West Africa, S. C. F. carried out a questionnaire among members of hunting communities in Nigeria (home of both pottos and angwantibos). We then conducted a comparison across West and Central Africa by distributing a questionnaire to a small sample of field biologists working in African lorisid range countries. Finally, we compare responses from both questionnaires to import/export data from the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) and a comprehensive literature review covering all African lorisid range countries. Through comparisons with ongoing research on slow lorises in Asia, we aim to identify common threats and possible shared solutions.

MATERIALS AND METHODS

Study species

Despite their large geographical distribution, African lorisids remain among the least studied pri-

mates (Nekaris & Bearder 2011, Pimley & Bearder 2013). Very few field studies with substantial effort have been published in the last 40 yr (e.g. Charles-Dominique 1977, Pimley et al. 2005a, 2005b). Recent research observing variations in potto and angwantibo genetics, pelage coloration, dorsal markings and tail characteristics suggests that a number of species of angwantibos and pottos are not currently recognised (Schwartz & Beutel 1995, Grubb et al. 2003, Stump 2005, Ravosa 2007, Pimley 2009, Oates 2011, Butynski 2013).

Even though there is an almost complete dearth of knowledge about these taxa, all are listed on the 2013 International Union for Conservation of Nature and Natural Resources (IUCN) Red List of Threatened Species as Least Concern (Bearder et al. 2008, Oates & Bearder 2008, Oates et al. 2008). They are all listed under CITES Appendix II (CITES 2013), and are protected under Class B of the African Convention which only allows hunting, killing or capturing of the species with special authorisation (African Union 2009).

Village surveys

From July to December 2012, interviews were conducted with 327 participants living in hunting communities on the edge ($n = 2$ communities), in the support zone ($n = 2$), and within ($n = 1$) the Oban Division of Cross River National Park, southeast Nigeria. The vegetation in this area is characteristic of lowland rainforest, forming a mosaic of disturbed and relatively undisturbed forest patches. Edge communities are surrounded by farmland, plantations and disturbed forest patches, while all other communities are surrounded by community farms and disturbed and undisturbed forest. Hunters in the focal communities are commonly hunter-farmers, often sleeping and hunting in both forest and farmland, hunting night and/or day. S. C. F. carried out oral questionnaires with 178 hunters and 149 non-hunters (see the Supplement at www.int-res.com/articles/suppl/n023p107_supp.pdf). We define a hunter as any individual who hunted with a gun at any time in his life or who set traps regularly for more than 2 yr. Non-hunters were therefore considered to be individuals who never hunted with a gun, but may have used traps for 2 yr or less. Only men were invited to participate since women in the area do not hunt. Recruitment of participants occurred primarily through meetings with village heads, hunter groups and in-home visits. Non-hunters were chosen at random,

using a drawn village map from which households were randomly selected. All participants underwent a modified oral consent process followed by an orally administered questionnaire, with the aid of a local translator. All research activities were approved by the University of Wisconsin-Madison Institutional Review Board (protocol no. SE-2011-0859).

Questionnaires and literature review

Thirty-nine questionnaires were distributed to researchers who live in or have conducted fieldwork in range countries of pottos and/or angwantibos (Angola, Cameroon, Central African Republic [CAR], Democratic Republic of Congo [DRC], Gabon, Ivory Coast, Kenya, Nigeria, Republic of Congo, Republic of Guinea, Rwanda and Uganda). We present the results from the questionnaires as percentages (%) or y/z , where y is the number of participants who gave the response, and z is the total number of participants who were asked the specific question. We also present threats and beliefs specific to pottos and angwantibos compiled from a contemporary literature review (post-1969, as no relevant research publications were found prior to this date).

We downloaded data on the imports and exports of all loriformes from the CITES trade database (www.cites.org) from the period 1975 to 2012 and grouped them into trade in live individuals and trade in bodies or body parts (import terms: bodies, skeletons, bones, trophies, skulls). We pooled all species into their respective genera. In the cases where we found discrepancies between import and export volumes (for example, Togo reported the export of 536 pottos to Japan between 1985 and 1998 and Japan reported the import of 594 from Togo for the same period) we used the higher numbers.

RESULTS

Hunting of pottos in southern Nigeria

Hunters in Nigerian focal communities report hunting African loriformes for food and medicine, and rarely keeping them as pets. Hunters in our study generally did not differentiate between pottos and angwantibos. Both were classified as 'dechai' (Iko language) and 'efe' (Ejagham language), or called foxes in English. We subsequently did not differentiate between pottos and angwantibos in our questionnaires, and both are reported here as African loriformes. Overall,

64% (208/327) of respondents reported having eaten African loriformes at least once. Of these 208 individuals, 72% (150/208) reported consuming them often (at least once a month) and 47% (98/208) reported consuming them on a weekly basis. None of the respondents listed them as their favourite or most commonly consumed bushmeat. Two respondents categorised the meat of African loriformes as children's meat, since the meat is not enough to feed a family. One respondent categorised pottos as condiments and not enough to eat on their own. However, respondents pointed out that for such small animals, they yielded a surprisingly large amount of meat. While the meat of African loriformes was considered very tough and needed to be cooked for a whole day, it was ultimately considered very sweet, or good to eat. There were no taboos preventing them from eating African loriformes. Of the respondents, 1.5% (5/327) had first-hand knowledge of the use of African loriformes for medicinal purposes. Three of these reported the use of African loriformes by pregnant women, one of them explaining that pregnant women roast the legs of the African loriformes and eat the meat to make the body strong. We were told of the expression 'if women's baby grabs you well, you will know that woman ate potto'. One respondent reported the use of African loriformes to cure a cough by drinking the water it was boiled in. Another respondent reported the use of African loriformes' bones, which are burnt, grinded and then smeared over the body to strengthen it. Finally, 1 respondent reported using African loriformes to cure gonorrhoea, where he would boil the meat without any pepper, but with salt, then drink the water. Only 1 respondent out of 327 reported ever having kept an African loriformid as a pet.

Of those informants that regularly hunt, 75% (133/178) reported having killed African loriformes at least once. Out of these 133 individuals, 82% (109/133) reported having killed them often (at least once a month), and 54% (72/133) reported killing them on a weekly basis. African loriformes were reported as being caught on people's farms as well as in the forest. Meat from African loriformes was used mainly for subsistence, and only 5% (6/133) reported selling it. African loriformes were often referred to as housemeat, i.e. meat that is not big enough to sell. In comparing reported frequencies of hunts, we found African loriformes to be the most commonly hunted primate, comprising 22% of the total number of primates (other species were putty-nosed guenon *Cercopithecus nictitans*, mona monkey *Cercopithecus mona*, drill *Mandrillus leucophaeus*, red-eared guenon *Cer-*

copithecus erythrotis, red-capped mangabey *Cercocebus torquatus*, red-colobus *Procolobus badius*, chimpanzee *Pan troglodytes* and galagos [grouped]). Hunters did not report targeting African lorises during hunts, but killed them opportunistically. They reported reluctance to waste bullets on such a small animal, and said they were easily killed with a machete.

Threats to pottos and angwantibos throughout their range

We received 30 completed questionnaires, out of the 39 sent out to field biologists living or working in range countries (Fig. 1). According to the respondents, pottos and/or angwantibos are hunted for food, medicine and/or kept as pets in 58% of the 12 represented countries. Of the respondents, 33% (from DRC, Uganda, Nigeria, Liberia, Republic of Congo, CAR, Cameroon Ivory Coast and Gabon) had heard of pottos being hunted, but only 20% (from Cameroon, Nigeria, CAR and Republic of Congo) had heard of, or seen first-hand, angwantibos being hunted. In addition, 17% (from Nigeria, CAR, Cameroon, Liberia and Uganda) of the respondents mentioned that pottos and angwantibos are not usually targeted by hunters, but are caught accidentally or opportunistically. A hunter in the Republic of Congo reported that he would kill whatever he could find in the forest, no matter what the species, as the forest had been over-hunted in the past and the forest was quite empty (Fig. 2). Just 7% (from Nigeria) reported pottos as fat enough to eat and sell, whilst the angwantibos were not sold, but instead often consumed by hunters in the forest. Only 1 of the respondents had seen pottos and

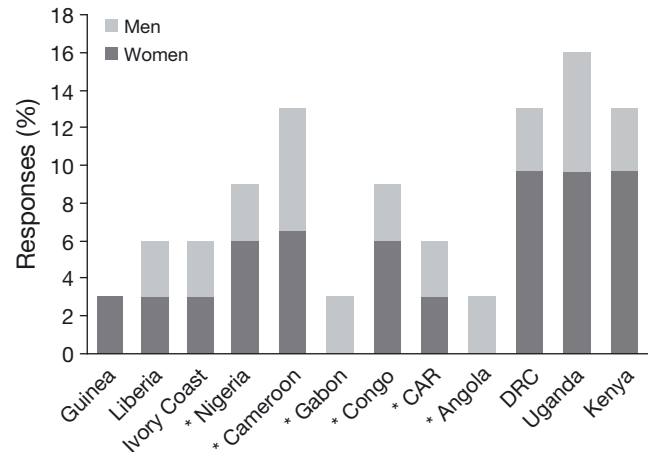


Fig. 1. Distribution (%) of questionnaire responses (west to east). (*) Countries in which both pottos *Perodicticus* spp. and angwantibos *Arctocebus* spp. occur. CAR = Central African Republic, DRC = Democratic Republic of Congo

angwantibos in markets (in both DRC and the Republic of Congo), as fur and burnt remains, and 7% (from Nigeria and Cameroon) of the respondents reported pottos as more commonly sold in villages and roadsides than in large markets (Fig. 2).

None of the respondents had seen angwantibos sold as pets, but pottos sold as pets were reported by 13% (from Nigeria, Liberia and DRC) (Fig. 2). An ex-hunter in Nigeria had told the respondent how pottos are hunted for the pet trade as they make good pets for 'crazy rich people'. One respondent had heard of hunters bringing potto infants home for their children to play with (Nigeria). The use of pottos and/or angwantibos for traditional medicine or witchcraft had been heard of by 10% (from CAR, Cameroon, Republic of Congo and Gabon). One respondent

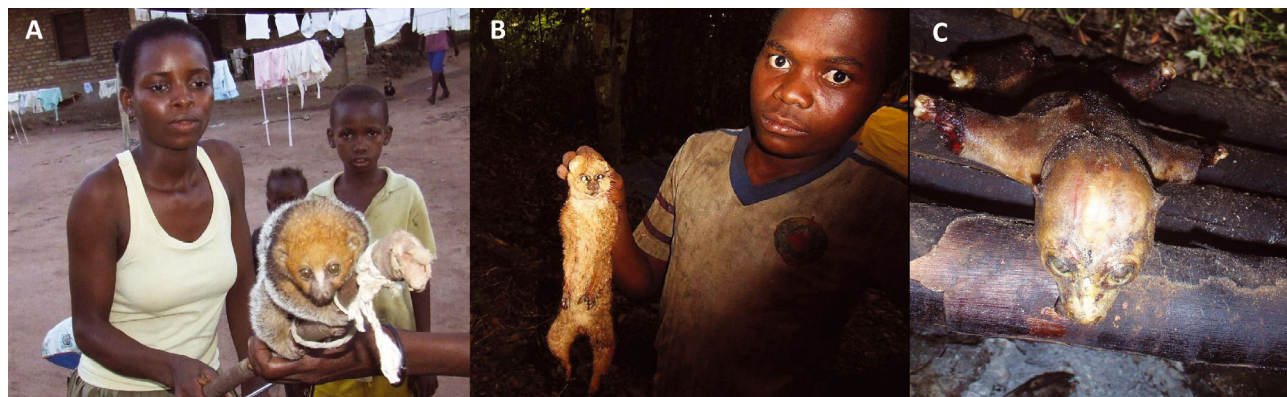


Fig. 2. *Perodicticus* spp. and *Arctocebus* spp. (A) Potto sold as a pet in the Democratic Republic of Congo (photograph courtesy of C. Hicks). (B) Angwantibo hunted in the Republic of Congo (photograph courtesy of J. Dewilde). (C) Smoked potto carcass in Nigeria (photograph by S. Friant)

(from CAR) reported the use of potto/angwantibo heart in traditional medicine to protect people from any unfortunate situations.

From our literature review, we found 20 reports of hunting or trade in pottos and/or angwantibos spanning 12 range countries (Table 1). We found reports of both pottos (17/20) and angwantibos (7/20) being hunted, found in bushmeat markets, or consumed by local people. In Equatorial Guinea, pottos were one of the few species occurring in markets during both dry and wet seasons, although in low numbers (7% of the total primate carcass count) (Juste et al. 1995). Wright & Priston (2010) found nocturnal prosimians to be hunted by 51% of hunters interviewed in Cameroon. The most commonly reported technique for hunting pottos was snares and traps, followed by shooting (guns and arrows) (Carpaneto & Germi 1989, Juste et al. 1995, Fa & García 2001, Keylock 2002). Capturing by hand was only mentioned once

(Wright & Priston 2010). The CITES database includes reports of pottos being hunted as trophies.

A taboo with respect to the consumption of pottos was only mentioned once, where pregnant women in north-eastern DRC would refrain from eating pottos. They believed that eating potto meat would cause their babies to have trouble breathing and create complications during delivery, as 'the baby would grasp the mother's womb firmly like the potto grasps the branches of the tree' (Carpaneto & Germi 1989, p. 13). Three studies mention the consumption of pottos (inner organs, hearts or feet) as traditional medicine/witchcraft. In all mentioned cases, pottos were said to give the consumer or their baby more strength and power (Laurent 1992, Carpaneto 1994, Tchigio 2007). Other uses include mixing potto hair with honey to cure burns (Ghana; Ntiamoa-Baidu 1992), and use of potto body parts for decoration and/or as amulets when hunting or collecting honey (DRC;

Table 1. *Perodicticus* spp. and *Arctocebus* spp. Hunting, trade and usage of pottos and angwantibos throughout their range. Slow loris *Nycticebus* spp. is included for comparison. No information was available from Angola, Burundi, Guinea, Kenya, Rwanda, Sierra Leone and Togo (*Perodicticus* spp., *Arctocebus* spp.), and Bhutan (*Nycticebus* spp.). P = potto, A = angwantibo, N = *Nycticebus* spp., CAR = Central African Republic, DRC = Democratic Republic of Congo, Lao PDR = Lao People's Democratic Republic. Gaps indicate no information available

Range countries	Bushmeat hunting	Pet trade	Traditional medicine	Source
<i>Perodictus</i> spp. and <i>Arctocebus</i> spp.				
Benin			P	Djagoun et al. (2013)
Cameroon ^a	P, A		P	Ambrose (1999), Fa et al. (2006), Willcox & Nambu (2007), S. Bearder pers. comm.
CAR ^a	P, A		P	T. Fuh pers. comm.
Republic of Congo ^a	P, A			Mbete et al. (2011), J. Dewilde pers. comm.
DRC	P	P	P	Carpaneto & Germi (1989), C. Hicks pers. comm.
Equatorial Guinea ^a	P, A			Juste et al. (1995), Fa & García (2001), Keylock (2002)
Gabon ^a	P			Steel (1994)
Ghana	P		P	Ntiamoa-Baidu (1992), Hofmann et al. (1999)
Ivory Coast	P			Hofmann et al. (1999)
Liberia	P	P		Greengrass (2011), Bene et al. (2013), T. Plat pers. comm.
Nigeria ^a	P, A			Jewell & Oates (1969), Anadu et al. (1988), Fa et al. (2006), Oates & Bearder (2008)
Uganda	P			Olupot et al. (2009)
<i>Nycticebus</i> spp.				
Bangladesh		N		A. Nekaris pers. comm.
Brunei		N		A. Nekaris pers. comm.
Cambodia	N	N	N	Ashwell & Walston (2008), Starr et al. (2010)
China		N	N	Li & Wang (1999)
India			N	Srivastata (1999)
Indonesia		N	N	Nekaris et al. (2010), Mittermeier et al. (2012)
Lao PDR	N		N	V. Nijman pers. comm.
Malaysia		N		Bennett et al. (1987)
Myanmar		N	N	Shepherd & Nijman (2007)
Philippines		N		A. Nekaris pers. comm.
Singapore		N		Shun Deng unpubl.
Thailand		N	N	Nekaris et al. (2010)
Vietnam		N	N	Van & Tap (2008)
^a Countries where both species occur				

Carpaneto & Germi 1989). We found no reports in the literature of either pottos or angwantibos occurring in the pet trade.

Angwantibos, but in particular pottos are internationally traded in significant quantities both as live individuals and body parts (Table 2). Fewer African lorises are traded than slow lorises. African countries that export pottos are the Republic of Congo, Cameroon, Egypt, Ghana, Guinea, Togo and Liberia, whilst angwantibos are exported from Liberia, Cameroon and Gabon. The highest levels of international trade in pottos and angwantibos are recorded from Cameroon, Togo and Hong Kong, followed by the United Arab Emirates, the USA and Egypt. In particular, Togo, Cameroon and Egypt export a high proportion of live African lorises, although Egypt is not a range country. The main importing countries are Japan (637 pottos and 10 angwantibos) and the USA (191 pottos) (CITES 2013).

DISCUSSION

The anecdotes we present here are not an attempt to quantify the prevalence of certain threats and beliefs concerning angwantibos and pottos, but to document their existence in order to present a broad scale comparison across their range and with the Asian lorises.

Angwantibos, and particularly pottos, frequently appear in bushmeat reports throughout their range, suggesting this is a real threat to these cryptic primates. Our results show that the bushmeat trade, when compared with all other trades, appears to be the primary threat to pottos and angwantibos. The bushmeat trade, combined with ongoing habitat loss, poses a great impediment to the conservation of African lorises (Nekaris 2013).

In the Nigerian hunting communities studied in this paper, we found pottos to be the most commonly

hunted primate, despite the fact that their meat is not favoured and requires long preparation times to make it edible. According to old Cameroonian cookbooks, the meat of the potto is too tough to be worth eating. Nevertheless, pottos are hunted opportunistically and with machetes. Together, these descriptions suggest that pottos are not prime targets, but frequent prey because they are easy to kill and there is no associated cost of a lost bullet. Additionally, pottos may be a more common prey of hunter-farmers who work on their farms in the daytime and mostly hunt at night. Of the 327 people asked, 46% consumed pottos at least once a month. This is on a larger scale than that found in most of the literature (e.g. Anadu et al. 1988, Juste et al. 1995, Willcox & Nambu 2007), and may be an indication that hunting of both pottos and angwantibos is more common than previously known. The high frequency of hunting and consumption of pottos relative to other primates may also be indicative of the rapidly declining ape and monkey populations, rather than reflecting prey and food preferences. As larger game are becoming increasingly rare, and in some parts hunted to near total extinction, smaller animals are being subjected to increasing pressure from bushmeat hunting (Anadu et al. 1988). This trend was confirmed by the self-reported practices of 1 hunter in the Republic of Congo.

The responses in questionnaires given to field biologists provide reports of potto and angwantibo trade in new areas. The trade of both angwantibos and pottos as bushmeat, and the use of pottos in traditional medicine, was reported by a researcher in CAR, while nothing was found in the literature. There were also reports of the pet trade of pottos in the questionnaires (Nigeria, Liberia and DRC), but not in the literature. The CITES (2013) database reported that most pottos exported internationally come from Togo and Cameroon, yet there is no evidence in the literature of this international trade and there is an absence of information on trade and hunting of pot-

Table 2. *Arctocebus* spp., *Perodicticus* spp. and *Nycticebus* spp. Number of live and dead lorises traded for all purposes from 1975 to 2012. The 2 main importing and exporting countries for each species are given, with the number of traded animals in parentheses. 'Dead' includes whole bodies, skeletons, bones, trophies and skulls

Species	Live	Main importer	Main exporter	Dead	Main importer	Main exporter
<i>Arctocebus</i> spp.	11	Japan (10) Poland (1)	Cameroon (10) United Arab Emirates (1)	11	Hong Kong (4) Great Britain (4)	Hong Kong (4) USA (4)
<i>Perodicticus</i> spp.	872	Japan (637) USA (191)	Togo (765) Egypt (34)	27	Great Britain (11) Hong Kong (9)	Hong Kong (11) USA (9)
<i>Nycticebus</i> spp.	1644	Japan (633) USA (162)	Singapore (588) Laos (497)	151	USA (126) Great Britain (10)	Cambodia (89) Laos (24)

tos and angwantibos from Togo. Our findings highlight the gaps in the literature that may distort our understanding of the conservation of African lorises.

It is evident that the trade in African lorises is underrepresented in the conservation literature. Although mentioned in bushmeat and other trade reports, the information is often extremely limited, as only a few studies have been conducted on these species. With this initial exploratory study, we can start comparing the threats to pottos and angwantibos to those faced by Asian slow lorises. Their behavioural and ecological similarities, including relatively slow locomotion and infant parking, make both the Asian and African nocturnal primates easy to catch and vulnerable to hunting (Bearder et al. 2003, Nekaris 2013). Threats to pottos and angwantibos differ from slow lorises in that they seem to be targeted primarily as a food source. Although we found reports of pottos as pets, the trade seems limited compared to that of slow lorises, both internationally and nationally (Nekaris & Nijman 2007). However, while the trade in slow lorises for traditional medicine is now well documented (e.g. Nekaris & Nijman 2007, Shepherd & Nijman 2007, Ashwell & Walston 2008, Nekaris et al. 2010, Starr et al. 2010), we find that this is also a conservation concern for African lorises, especially for the potto.

There are no indications in the literature that the trade in angwantibos and pottos is on the rise, as has been shown for Asian lorises. However, through our questionnaires, especially from Nigeria, we can see that it appears to be relatively common despite national and international legislation (African Union 2009, CITES 2013). There is a great deal of scope for *in situ* studies on African lorises. We currently do not have the data to effectively assess their conservation status. Further studies on the trade of these African nocturnal primates are essential for understanding the impact the trade is having on these species, and ultimately their conservation.

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